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**Winner et al.**

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(54) **ANONYMOUS SINGLE SIGN-ON TO THIRD-PARTY SYSTEMS**

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CPC ..... ***H04L 63/0421*** (2013.01); ***H04L 63/0815*** (2013.01); *H04L 63/0807* (2013.01); *H04L 67/10* (2013.01)

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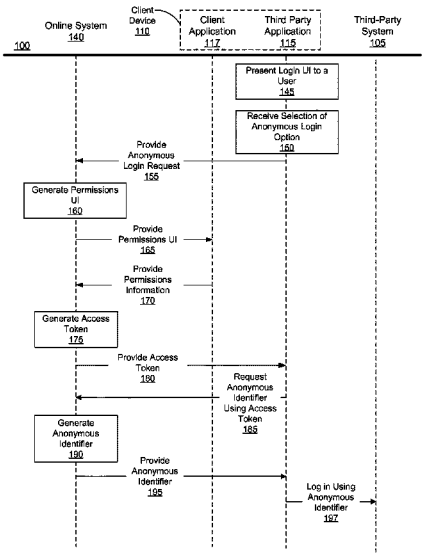
(57) **ABSTRACT**

An online system receives from a third-party application on a client device, an anonymous login request to anonymously log a user of the online system into a third-party system associated with the third-party application. Responsive to receiving the anonymous login request, the online system generates a permissions user interface (UI) that provides an interface component including an option for the user to anonymously log into the third-party system using the user's login information for the online system. The online system provides the permissions UI to the client device, and receives permissions information from the client device. The online system generates an anonymous identifier that allows the user to login to the third-party system. The online system provides the anonymous identifier to the third-party application to allow anonymous login of the user into the third-party system in accordance with the permissions information.

**21 Claims, 7 Drawing Sheets**



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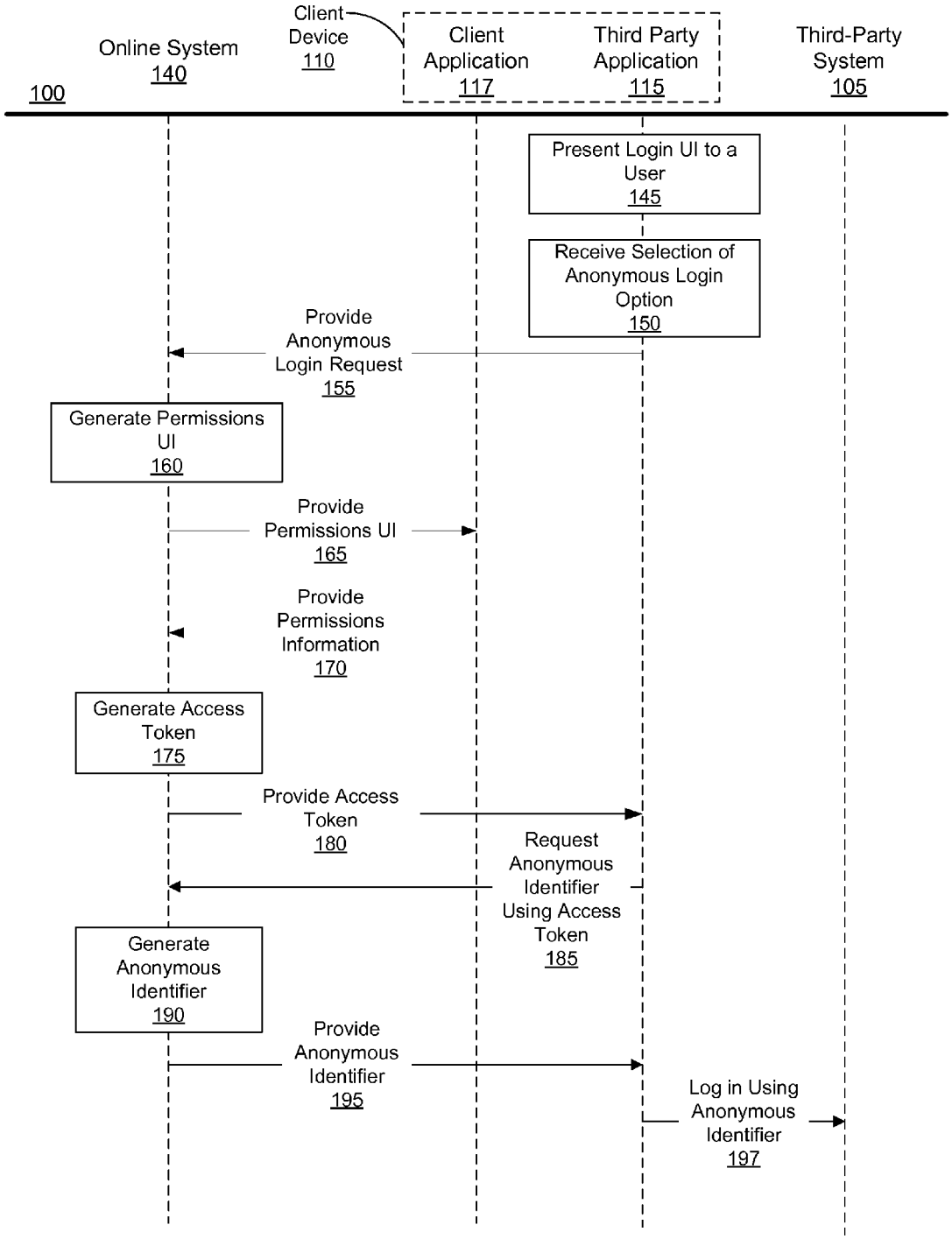
100
Online System
140
Client
Device
110
Client
Application
117
Third Party
Application
115
Third-Party
System
105
Present Login UI to a User
145
Receive Selection of Anonymous Login Option
150
Provide Anonymous Login Request
155
Generate Permissions UI
160
Provide Permissions UI
165
Provide Permissions Information
170
Generate Access Token
175
Provide Access Token
180
Request Anonymous Identifier Using Access Token
185
Generate Anonymous Identifier
190
Provide Anonymous Identifier
195
Log in Using Anonymous Identifier
197

FIG. 1

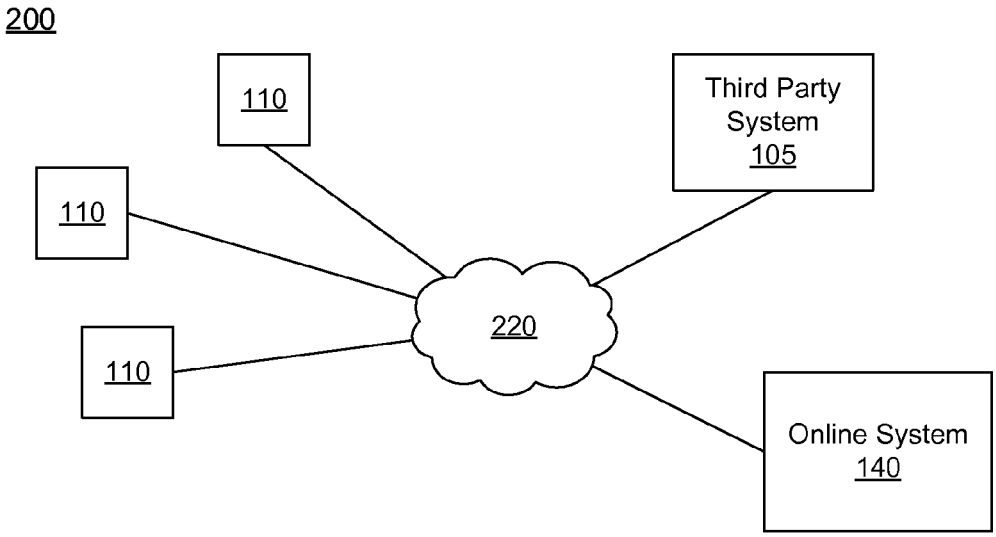
200
110
110
110
220
Third Party System 105
Online System 140

FIG. 2

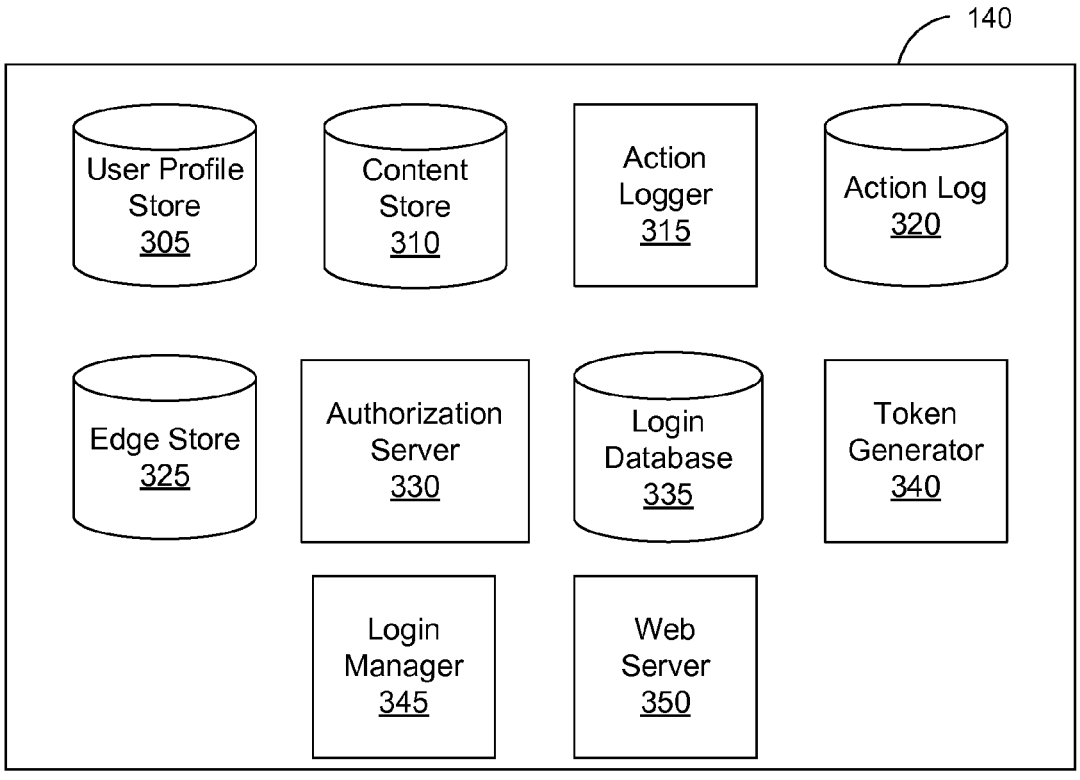
140
User Profile Store 305
Content Store 310
Action Logger 315
Action Log 320
Edge Store 325
Authorization Server 330
Login Database 335
Token Generator 340
Login Manager 345
Web Server 350

FIG. 3

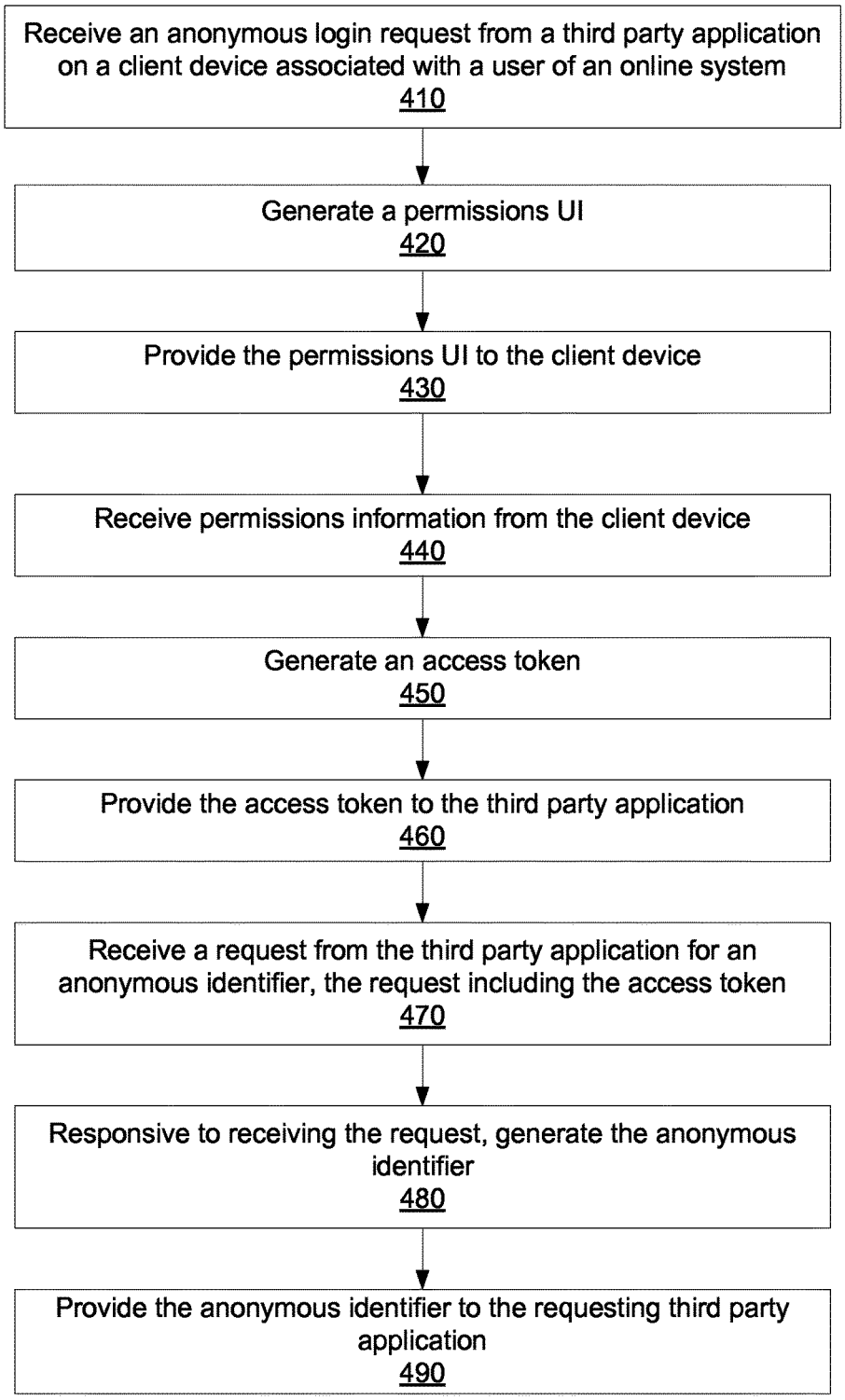
Receive an anonymous login request from a third party application on a client device associated with a user of an online system
410
Generate a permissions UI
420
Provide the permissions UI to the client device
430
Receive permissions information from the client device
440
Generate an access token
450
Provide the access token to the third party application
460
Receive a request from the third party application for an anonymous identifier, the request including the access token
470
Responsive to receiving the request, generate the anonymous identifier
480
Provide the anonymous identifier to the requesting third party application
490

FIG. 4

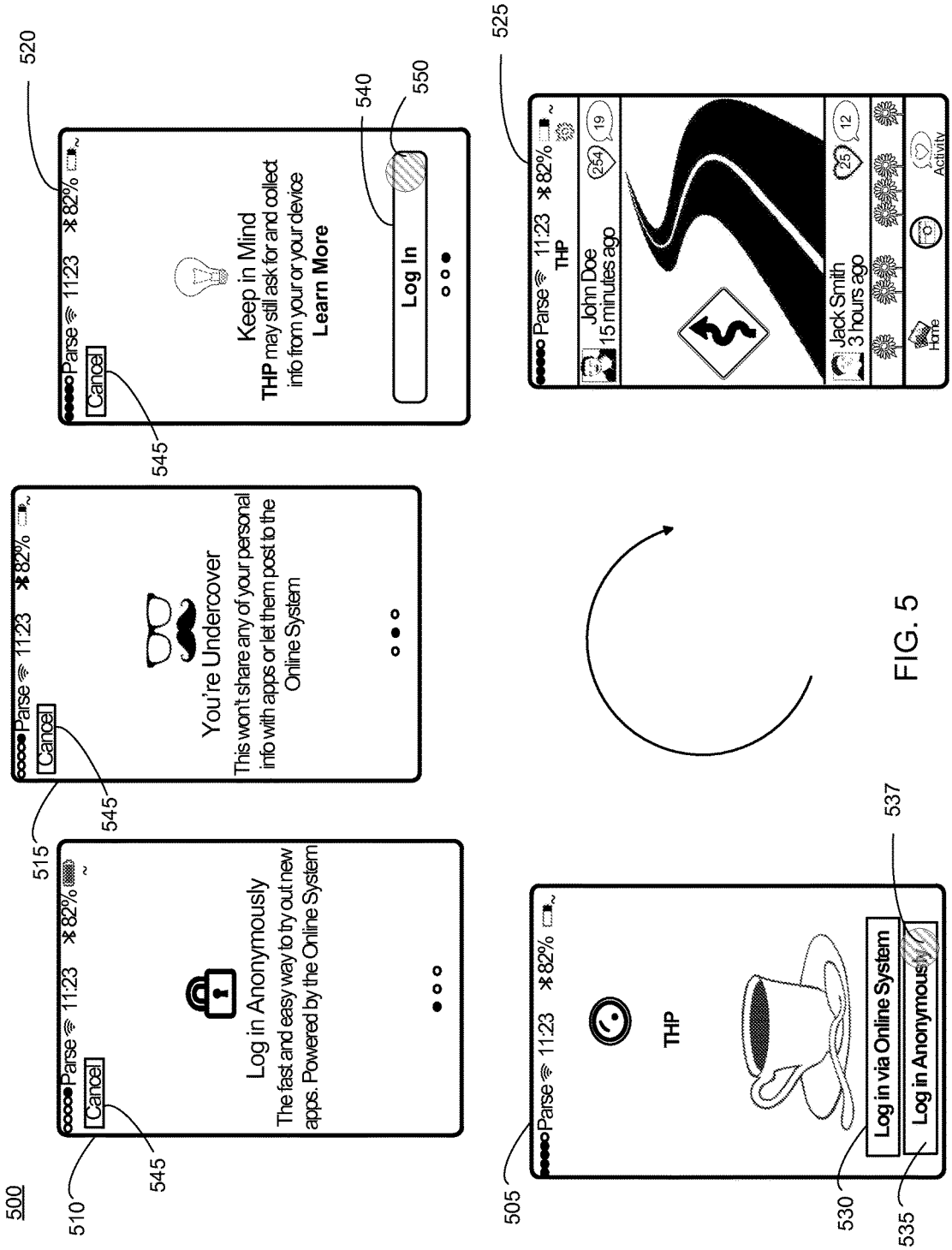
500
505
510
515
520
525
530
535
537
540
545
550
Parse 11:23 82%
Cancel
Log in Anonymously
The fast and easy way to try out new apps. Powered by the Online System
You're Undercover
This won't share any of your personal info with apps or let them post to the Online System
Keep in Mind
THP may still ask for and collect info from your or your device
Learn More
Log In
THP
Log in via Online System
Log in Anonymously
John Doe
15 minutes ago
Jack Smith
3 hours ago
Home
Activity

FIG. 5

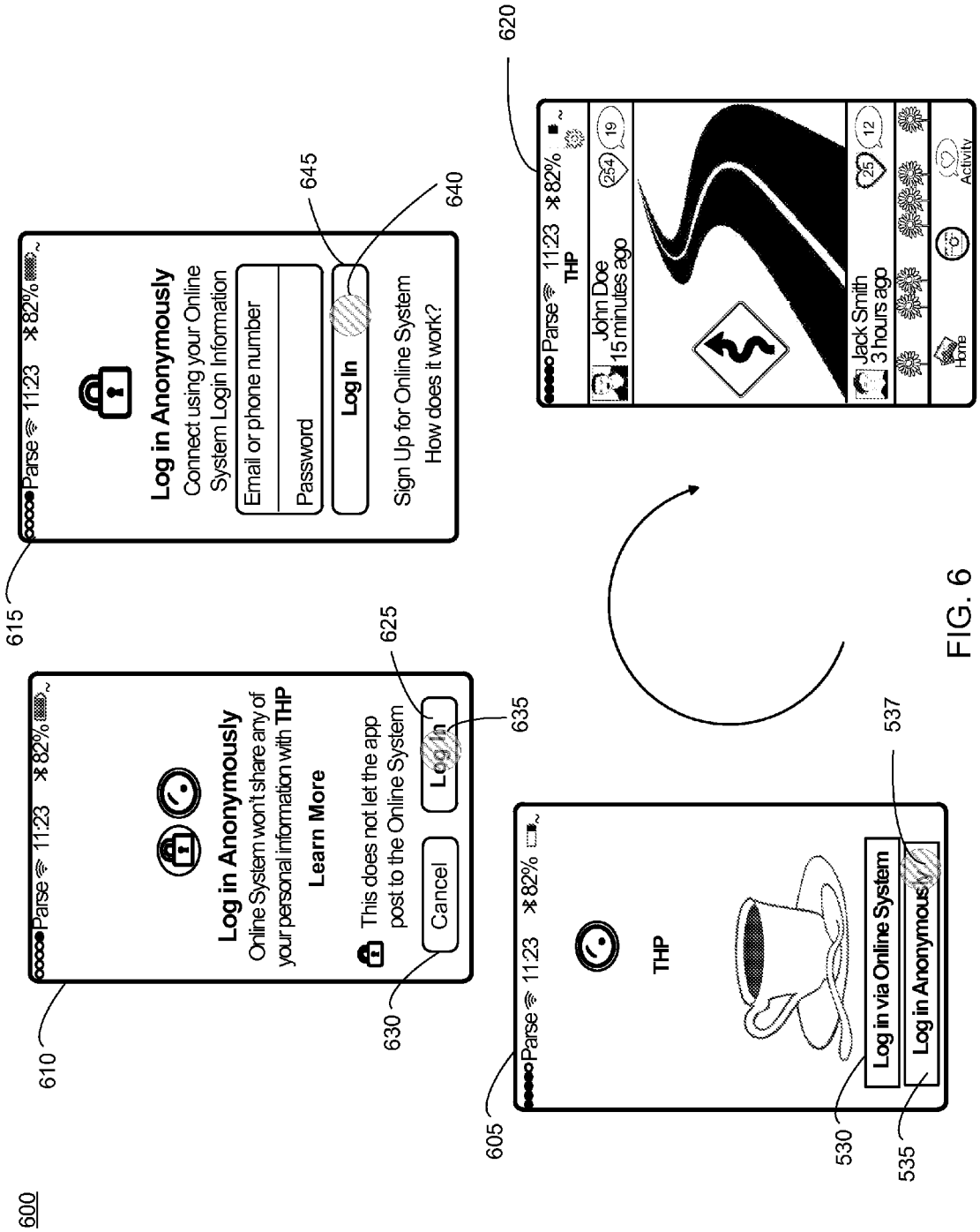
600
610
Parse 11:23 82%
Log in Anonymously
Online System won't share any of your personal information with THP
Learn More
This does not let the app post to the Online System
Cancel
Log In
625
630
635
615
Parse 11:23 82%
Log in Anonymously
Connect using your Online System Login Information
Email or phone number
Password
Log In
Sign Up for Online System
How does it work?
645
640
620
Parse 11:23 82%
THP
John Doe
15 minutes ago
254
19
Jack Smith
3 hours ago
25
12
Home
Activity
605
Parse 11:23 82%
THP
Log in via Online System
Log in Anonymously
530
535
537

FIG. 6

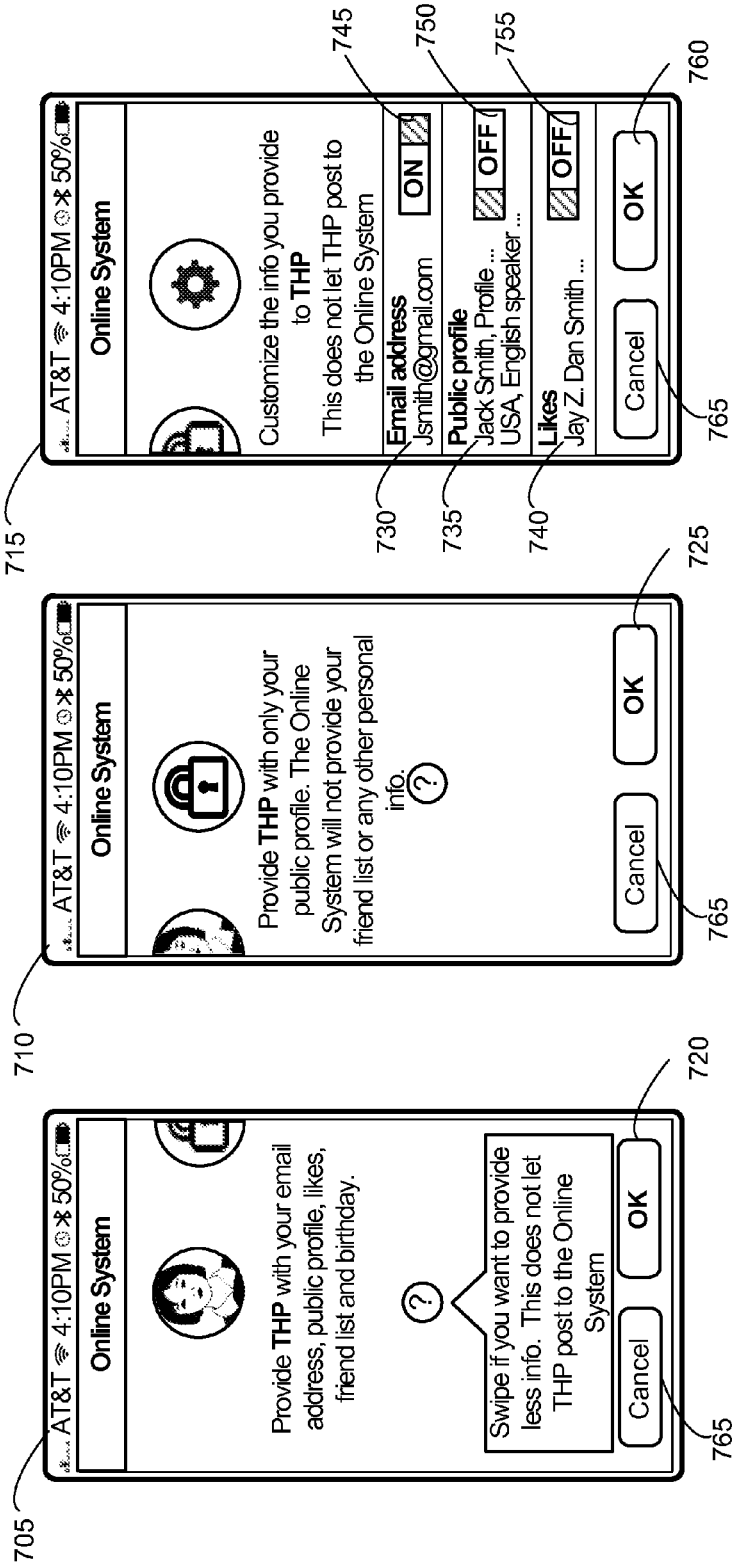
700
705
AT&T 4:10PM 50%
Online System
Provide THP with your email address, public profile, likes, friend list and birthday.
Swipe if you want to provide less info. This does not let THP post to the Online System
Cancel
OK
720
765
710
AT&T 4:10PM 50%
Online System
Provide THP with only your public profile. The Online System will not provide your friend list or any other personal info.
Cancel
OK
725
765
715
AT&T 4:10PM 50%
Online System
Customize the info you provide to THP
This does not let THP post to the Online System
Email address
Jsmith@gmail.com
ON
730
745
Public profile
Jack Smith, Profile ...
USA, English speaker ...
OFF
735
750
Likes
Jay Z. Dan Smith ...
OFF
740
755
Cancel
OK
765
760

FIG. 7

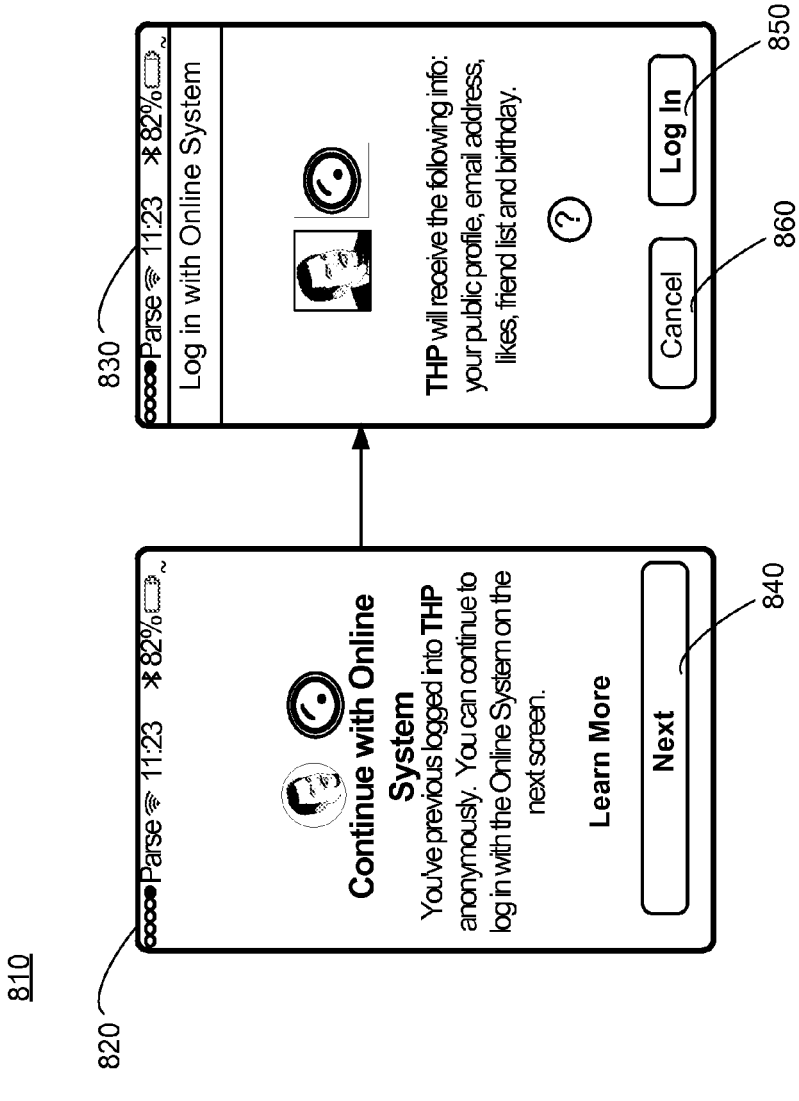
800
Parse 11:23 82%
Continue with Online System
You've used the Online System to log into THP before. That's OK- continue to log in with the Online System.
Learn More
Cancel
Log In
810
820
Parse 11:23 82%
Continue with Online System
You've previous logged into THP anonymously. You can continue to log in with the Online System on the next screen.
Learn More
Next
840
830
Parse 11:23 82%
Log in with Online System
THP will receive the following info: your public profile, email address, likes, friend list and birthday.
Cancel
Log In
850
860

FIG. 8A

FIG. 8B

# ANONYMOUS SINGLE SIGN-ON TO THIRD-PARTY SYSTEMS

## BACKGROUND

This disclosure relates generally to anonymous single sign-on of users into third-party systems, and in particular to providing a graduated single sign-on functionality that controls what, if any, information about a user is provided to the third-party system.

Users of digital devices with online systems regularly login into third-party systems via associated third-party applications, and the third-party systems require their own login information distinct from the login information for the online system. This results in a user having to maintain separate login information for each system. Additionally, as part of obtaining login information for a particular third-party system, the third-party system generally requires a user to provide some amount of information about the user (e.g., name, email, etc.) before access to that third-party system is provided to the user. Thus, in order for users to try out a third-party application and/or associated third-party system they must provide information about themselves to the third-party system.

In some cases, a login provider may provide a single sign-on type capability into third-party systems, where a user of the login provider logs into the login provider which then interacts with the third-party application to log the user into the third-party system. Currently login providers that provide this type of single sign-on capability always provide the third-party system with some amount of information about the user (e.g., email, profile pic, friends list, etc.). Thus, there does not exist a way for a user to log into a third-party system without some user-identifying information about the user being provided to the third-party system either from the login provider or the user.

## SUMMARY

An online system provides an anonymous single sign-on (ASSO) functionality for its users, in which a user can anonymously log into a third-party system using credentials provided by the online system. In some embodiments, when using the ASSO feature, a user may select an anonymous login option, in which the online system provides credentials to a third-party application associated with the third-party system without any of the user's personally identifiable information (PII), thus providing fully anonymous log in for the user into the third-party system. In other embodiments, when using the ASSO feature, a user may choose what types of the user's PII may be shared with the third-party application and/or third-party system, thus providing for a partially anonymous log in for the user into the third-party system. Additionally, in some embodiments, when using the ASSO feature, a user may create a persona and/or select a persona from one or more previously created personas that the online system can use to log the user into the third-party system. A user may configure each persona to specify what, if any, types of PII are shared with the third-party application and/or third-party system when the persona is used as part of the ASSO feature. Accordingly, the ASSO feature allows for a graduated approach to what, if any, of the user's PII is provided to the third-party application and/or third-party system.

When the user selects the anonymous login option from the third-party application, the application redirects the user to the online system. The online system generates a permissions user interface (UI) and provides the permissions UI to a client application (e.g., a browser, a single sign-on application for the online system, etc.) on the client device. The permissions UI obtains information from the user which is used to generate permissions information (e.g., some or all of the user's login information for the online system, what (if any) types of the user's PII may be shared with the third-party system, a selected persona, etc.). The permissions UI provides the permissions information to the online system. In some cases, the permissions UI is simply an interface from the online system that confirms that the user wishes to login anonymously to the third-party application, and the permissions information provided is the user's confirmation or selection of anonymous login via the online system permissions UI. The online system generates an anonymous identifier that allows the user to login to the third-party system, and provides the anonymous identifier to the third-party application to allow anonymous logging of the user into the third-party application without sharing any PII of the user with the third-party application and third-party system. The anonymous identifier provided by the online system is stable in that it does not change based on the client device of the user, but it is unique to the third-party application and/or the associated third-party system so that it provides no information about the user, allowing the user to be logged into the third-party system without providing any information (or even a password) to the third-party application and/or the third-party system.

In some embodiments, prior to generating the anonymous identifier, the online system generates an access token and provides it to the third-party application, which can use the access token to request the anonymous identifier of the user from the online system.



## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an interaction diagram of an example process for providing anonymous single sign-on login functionality to users of an online system into a third-party system, in accordance with an embodiment

FIG. **2** is a block diagram of a system environment in which an online system operates, in accordance with an embodiment.

FIG. **3** is a block diagram of an online system, in accordance with an embodiment.

FIG. **4** is a flowchart illustrating a process for providing anonymous single sign-on functionality to users of an online system for logging into third-party systems according to an embodiment

FIG. **5** illustrates a series of interfaces displayed to a user of a client device to provide fully anonymous login according to an embodiment.

FIG. **6** illustrates another series of interfaces displayed to a user of the client device to provide fully anonymous login according to an embodiment.

FIG. **7** illustrates a permissions user interface that provide graduated control of what personally identifiable information is provided to a third-party application, according to an embodiment.

FIG. **8**A illustrates a permissions user interface prompting a user to log into a third-party application using an online system, according to an embodiment

FIG. **8**B illustrates another permissions user interface redirecting a user to log into a third-party application using an online system, according to an embodiment.

The figures depict various embodiments for purposes of illustration only. One skilled in the art will readily recognize

from the following discussion that alternative embodiments of the structures and methods illustrated herein may be employed without departing from the principles of the disclosure described herein.

## DETAILED DESCRIPTION

### Overview

FIG. **1** is an interaction diagram of an example process **100** for providing anonymous single sign-on login functionality to users of an online system **140** (e.g., a social networking system) into a third-party system **105**. The process **100** includes a third-party application **115** operating on a client device **110** associated with a user of the online system **140**. The third-party application **115** is an application that logs into the associated third-party system **105**. In some embodiments, the third-party system **105** is an external entity that is separate from and external to the online system **140**. Alternatively, the third-party system **105** may be part of the online system **140**, but operates independent from the online system **140**. For example the third-party system **105** has login information that differs from the login information of the online system **140** and the third-party system **105** only has access to PII of users of the online system **140** if the users and/or the online system **140** expressly share the PII with the third-party system **105**.

The third-party application **115** presents **145** a login user interface (UI) to the user. The login UI prompts the user to select a login method from a plurality of different login method options. A login method is the method by which the user may be logged into the third-party system **105**. The login method options presented to the user include an anonymous login option, and in some embodiments may also include a validated login option and/or or a direct login option.

The anonymous login option is a login option which provides the user with graduated single sign-on (ASSO) capability with respect to the third-party application **115**. As discussed in detail below, ASSO allows a user to select what, if any, personally identifiable information (MI) about the user is shared with the third-party application **115** to login into the third-party system **105**. PII is information that can be used on its own or with other information to identify, contact, or locate a single person, or to identify an individual in context. PII may be, e.g., the name of the user, address or email address of the user, public profile of the user, phone number of the user, user demographic information, user credit card information, user social information (e.g., comments, likes, connections, etc.), some other information that may be used to contact, identify, and/or locate the user; or some combination thereof.

A user is not anonymous when they log into third-party system **105** via the validated login option or direct login option. The validated login option corresponds to the traditional single sign-on functionality, where, if selected, a user enters some or all of their login information for the online system **140**, and the online system **140** generates credentials that log the user into the third-party system **105**. While the validated login option does provide single sign-on functionality, the user's PII is shared with the third-party application **105**, and the validated login option does not provide the user with control over what portions of the user's PII are being shared with the third-party system **105**. For example, in some instances, selection of the validated login option may allow the online system **140** to share all of the user's PII with the third-party application **105**. The direct login option is a login option where the user logs directly into the third-party system **105** via the third-party application **115** using, e.g., a login and/or password specific to the third-party system **105**.

The third-party application **115** receives **150** a selection of the anonymous login option. Responsive to the selection of the anonymous login option, the third-party application **115** provides **155** an anonymous login request to the online system **140**.

Permissions information is the information received from the permissions UI that controls what, if any, of the user's PII may be shared with the third-party application **115** and/or the third-party application **105**. Permissions information may include, e.g., a user's login information (e.g., user ID, password, etc.) for the online system **140**; identify what, if any, personally identifiable information (PIT) of the user may be shared with the third-party application **115** and/or the third-party system **105**; identify a login persona, identify an alternate login methodology (e.g., validated login option), or some combination thereof.

The online system **140** generates **160** a permissions user interface (UI). The permissions UI is a graphical user interface composed of at least one interface component that obtains and/or confirms the user's permissions information. The permissions UI may include, e.g., one or more interface components requesting the user's login information for the online system **140**; one or more interface components allowing a user to select what, if any, PII may be shared with the third-party system **105**; one or more interface components explaining a login method; one or more interface components allowing a user to create and/or select a login persona; or some combination thereof.

In some embodiments, the online system **140** generates interface components for the permissions UI based in part on whether the user is currently logged into the online system **140**. For example, if the user is not already logged into the online system **140**, the permissions UI may include an interface component that prompts the user for their login information for the online system **140**. Additionally, in some embodiments, even if the user is already logged into the online system **140**, the online system **140** may include an interface component in the permissions UI requesting the user provide a portion of their login information (e.g., password) for the online system **140** prior to continuing with anonymous login.

In some embodiments, online system **140** generates interface components for the permissions UI based in part on a number of times the online system **140** has received anonymous login requests associated with the user and the third-party application **115**. For example, if the anonymous login request is the first such request received from the third-party application **115** for the user, the online system **140** may include one or more interface components that allow a user to choose what, if any, of the user's PII is provided to the third-party application **115**. A user may elect to share no PII (fully anonymous login), some of their PII (partially anonymous login), or all of their PII with the third-party application **115** and/or the third-party system **105**. In some embodiments, the interface components prompting for anonymous login result only in a fully anonymous login, and the user is not able to identify portions of their PII to share with the third-party application **115** and/or the third-party system **105**. Additionally, in some embodiments, a permissions UI presented to a user using the ASSO for the first time may include specific interface components that explain the ASSO process. The permissions UI may include different interface components when the user uses the ASSO a second time. For example, the interface components may include less explanation of the process.

In some embodiments where the user had previously logged into the third-party system **105** using ASSO, the permissions UI may include one or more interface components that prompt the user to confirm and/or update what PII of the user may be shared with the third-party application **115** and/or third-party system **105**.

In some embodiments, online system **140** generates interface components for the permissions UI based in part on whether the user had previously logged into the third-party application **115** using a validated login option. For example, if the user had previously logged into the third-party system **105** using a validated login option, the user's information would have been previously shared with the third-party application **115** and/or third-party system **105**, thus, diminishing the value of ASSO. Accordingly, the permissions UI may include interface components that, e.g., notify the user that they have previously logged in using a validated login option, notify the user that ASSO is not available for the third-party application **115**, provide a validated login option, or some combination thereof.

In some embodiments, the permissions UI may include an interface component that allows a user to create login personas and/or modify existing login personas. A login persona is a profile associated with the user that the online system **140** may use to anonymously log the user into the third-party system **105**. Each login persona identifies what portions of the use's PII may be shared, and what portions of the user's PII may not be shared with the third-party application **115** and/or the third-party system **105**. Additionally, a user is able to customize what portions of user PII are shared/not shared for each persona. For example, a user may create a first login persona that when used results is no user PII being shared with the third-party system **105**, a second login persona that when used results in only the user's email being shared with the third-party system **105**.

The online system **140** provides **165** the permissions UI to a client application **117** on the client device **110**. The client application **117** may be, e.g., a browser, a single sign-on application for the online system **140**, or an application that allows the online system **140** to exchange data with the client device **110** (e.g., a social networking application). Responsive to receiving permissions information from the user, the client application **117** provides **170** the permissions information to the online system **140**.

The online system **140** generates **175** an access token. In some embodiments, the access token is information that is used by the third-party application **115** to request an identifier for the user. In alternate embodiments, the access token is an identifier which the third-party application **115** uses to anonymously log the user into the third-party system **105**. The online system **140** stores the access token in a database (e.g., login database discussed below with reference to FIG. **2**) that maps a user identifier associated with the user to the access token. In some embodiments, the database may also map the access token to an anonymous identifier associated with the user and the third-party application **115**. The online system **140** provides **180** the access token to the third-party application **115**.

In some embodiments, the third-party application **115** requests **185** an anonymous identifier for the user, the request including the access token. An anonymous identifier is a stable identifier (i.e., does not change based on the client device **110** associated with the user) that is unique to the third-party system **105**, such that the third-party application **115** may use the anonymous identifier to log the user into the third-party system **105** without the online system **140** and/or the user providing information other than that specified by the permissions information to the third-party application **115** and/or an associated third-party system **105**. In some embodiments, the user does not even need to provide a password to the third-party application **115** and/or the third-party system **105**.

The online system **140** generates **190** the anonymous identifier using the access token. The online system **140** may generate the anonymous identifier by retrieving a previously generated anonymous identifier from the lookup table and/or creating a new anonymous identifier using the access token. The online system provides **195** the anonymous identifier to the third-party application **115**, and the third-party application **115** uses **197** the anonymous identifier to log the user into the third-party system **105**.

While the discussion above disclosed the online system **140** performing certain steps, in alternate embodiments, one or more of the steps performed by the online system **140** may be performed by the client application **117**.

System Architecture

FIG. **2** is a high level block diagram of a system environment **200** for an online system **140**. The system environment **200** shown by FIG. **2** comprises one or more client devices **110**, a network **220**, one or more third-party systems **105**, and the online system **140**. In alternative configurations, different and/or additional components may be included in the system environment **200**. The embodiments described herein can be adapted to social networking systems that are not online systems.

The client devices **110** are one or more computing devices capable of receiving user input as well as transmitting and/or receiving data via the network **220**. In one embodiment, a client device **110** is a conventional computer system, such as a desktop or laptop computer. Alternatively, a client device **110** may be a device having computer functionality, such as a personal digital assistant (PDA), a mobile telephone, a smartphone or another suitable device. A client device **110** is configured to communicate via the network **220**. In one embodiment, a client device **110** executes an application allowing a user of the client device **110** to interact with the online system **140**. For example, a client device **110** executes a browser application to enable interaction between the client device **110** and the online system **140** via the network **220**. In another embodiment, a client device **110** interacts with the online system **140** through an application programming interface (API) running on a native operating system of the client device **110**, such as IOS® or ANDROID™.

As discussed above, each client device **110** includes the client application **117** and the third-party application **115**. As discussed above, the client application **117** may be, e.g., a browser, a single sign-on component of the online system **140**, or an application that allows the online system **140** to exchange data with the client device **110** (e.g., a social networking application). The client application **117** presents a permissions UI to the user, and provides permissions information received from the user to the online system **140**.

The third-party application **115** may be any application capable of presenting content to the client device user that is associated with a third-party system **105**. For example, third-party application **115** may be a photo sharing application that receives content from the third-party system **105**. The third-party application **115** is configured to present a login UI to the user. The login UI includes an anonymous login option that if selected, causes the third-party application **115** to send an anonymous login request to the online system **140**. In some embodiments, the login UI may also include other login method options (e.g., direct login and/or

validated login). The third-party application **115** is configured to use an access token to request an anonymous identifier that may be used to anonymously log in the user to the third-party system **105**. In some embodiments, the third-party application **115** is configured to use the access token to anonymously log in the user to the third-party system **105**. In some embodiments, the anonymous login option may be created using a software development kit (SDK). The online system **140** may make available the SDK software to software developers for third-party systems **105**. The third-party application **115** is configured to provide some and/or all PII for a user received from, for example, the user and/or the online system **140** to the third-party system **105**.

The client devices **110** are configured to communicate via the network **220**, which may comprise any combination of local area and/or wide area networks, using both wired and/or wireless communication systems. In one embodiment, the network **220** uses standard communications technologies and/or protocols. For example, the network **220** includes communication links using technologies such as Ethernet, 802.11, worldwide interoperability for microwave access (WiMAX), 3G, 4G, code division multiple access (CDMA), digital subscriber line (DSL), etc. Examples of networking protocols used for communicating via the network **220** include multiprotocol label switching (MPLS), transmission control protocol/Internet protocol (TCP/IP), hypertext transport protocol (HTTP), simple mail transfer protocol (SMTP), and file transfer protocol (FTP). Data exchanged over the network **120** may be represented using any suitable format, such as hypertext markup language (HTML) or extensible markup language (XML). In some embodiments, all or some of the communication links of the network **220** may be encrypted using any suitable technique or techniques.

One or more third-party systems **105** may be coupled to the network **220** for communicating with the online system **140**, which is further described below in conjunction with FIG. **3**. The third-party system **105** is an entity that is external to and separate from the online system **140**. Alternatively, the third-party system **105** may be part of the online system **140**, but operates independent from the online system **140**. In one embodiment, a third-party system **105** is an application provider communicating information describing applications (i.e., the third-party application **115**) for execution by a client device **110** or communicating data to client devices **110** for use by the third-party application **115** executing on the client device **110**. In other embodiments, a third-party system **105** provides content or other information for presentation via the third-party application **115**. A third-party system **105** may also communicate information to the online system **140**, such as advertisements, content, or information about the third-party application **115** provided by the third-party system **105**. The third-party system **105** may receive portions of the user's PII in accordance with permissions information for users of the online system **140** from the online system **140**, the third-party application **115**, the users of the online system **140**, or some combination thereof.

FIG. **3** is an example block diagram of an architecture of the online system **140**. The online system **140** shown in FIG. **3** includes a user profile store **305**, a content store **310**, an action logger **315**, an action log **320**, an edge store **325**, authorization server **330**, a login database **335**, a token generator **340**, a login manager **345**, and a web server **350**. In other embodiments, the online system **140** may include additional, fewer, or different components for various applications. Conventional components such as network interfaces, security functions, load balancers, failover servers, management and network operations consoles, and the like are not shown so as to not obscure the details of the system architecture.

Each user of the online system **140** is associated with a user profile, which is stored in the user profile store **205**. A user profile includes declarative information about the user that was explicitly shared by the user and may also include profile information inferred by the online system **140**. In one embodiment, a user profile includes multiple data fields, each describing one or more attributes of the corresponding user of the online system **140**. Examples of information stored in a user profile include biographic, demographic, and other types of descriptive information, such as work experience, educational history, gender, hobbies or preferences, location and the like. A user profile may also store other information provided by the user, for example, images or videos. In certain embodiments, images of users may be tagged with identification information of users of the online system **140** displayed in an image. A user profile in the user profile store **305** may also maintain references to actions by the corresponding user performed on content items in the content store **310** and stored in the action log **320**.

While user profiles in the user profile store **305** are frequently associated with individuals, allowing individuals to interact with each other via the online system **140**, user profiles may also be stored for entities such as businesses or organizations. This allows an entity to establish a presence on the online system **140** for connecting and exchanging content with other social networking system users. The entity may post information about itself, about its products or provide other information to users of the social networking system using a brand page associated with the entity's user profile. Other users of the social networking system may connect to the brand page to receive information posted to the brand page or to receive information from the brand page. A user profile associated with the brand page may include information about the entity itself, providing users with background or informational data about the entity.

The content store **310** stores objects that each represent various types of content. Examples of content represented by an object include a page post, a status update, a photograph, a video, a link, a shared content item, a gaming application achievement, a check-in event at a local business, a brand page, or any other type of content. Online system users may create objects stored by the content store **310**, such as status updates, photos tagged by users to be associated with other objects in the social networking system, events, groups or applications. In some embodiments, objects are received from third-party applications or third-party applications separate from the online system **140**. In one embodiment, objects in the content store **310** represent single pieces of content, or content "items." Hence, users of the online system **140** are encouraged to communicate with each other by posting text and content items of various types of media through various communication channels. This increases the amount of interaction of users with each other and increases the frequency with which users interact within the online system **140**.

The action logger **315** receives communications about user actions internal to and/or external to the online system **140**, populating the action log **320** with information about user actions. Examples of actions include adding a connection to another user, sending a message to another user, uploading an image, reading a message from another user, viewing content associated with another user, attending an

event posted by another user, among others. In addition, a number of actions may involve an object and one or more particular users, so these actions are associated with those users as well and stored in the action log **320**.

The action log **320** may be used by the online system **140** to track user actions on the online system **140**, as well as actions on third-party systems **105** that communicate information to the online system **140**. Users may interact with various objects on the online system **140**, and information describing these interactions are stored in the action log **310**. Examples of interactions with objects include: commenting on posts, sharing links, and checking-in to physical locations via a mobile device, accessing content items, and any other interactions. Additional examples of interactions with objects on the online system **140** that are included in the action log **320** include: commenting on a photo album, communicating with a user, establishing a connection with an object, joining an event to a calendar, joining a group, creating an event, authorizing an application, using an application, expressing a preference for an object ("liking" the object) and engaging in a transaction. Additionally, the action log **320** may record a user's interactions with advertisements on the online system **140** as well as with other applications operating on the online system **140**. In some embodiments, data from the action log **320** is used to infer interests or preferences of a user, augmenting the interests included in the user's user profile and allowing a more complete understanding of user preferences.

The action log **320** may also store user actions taken on a third-party system **105**, such as an external website, and communicated to the online system **140**. For example, an e-commerce website that primarily sells sporting equipment at bargain prices may recognize a user of an online system **140** through a social plug-in enabling the e-commerce website to identify the user of the online system **140**. Because users of the online system **140** are uniquely identifiable, e-commerce websites, such as this sporting equipment retailer, may communicate information about a user's actions outside of the online system **140** to the online system **140** for association with the user. Hence, the action log **320** may record information about actions users perform on a third-party system **105**, including webpage viewing histories, advertisements that were engaged, purchases made, and other patterns from shopping and buying.

In one embodiment, an edge store **325** stores information describing connections between users and other objects on the online system **140** as edges. Some edges may be defined by users, allowing users to specify their relationships with other users. For example, users may generate edges with other users that parallel the users' real-life relationships, such as friends, co-workers, partners, and so forth. Other edges are generated when users interact with objects in the online system **140**, such as expressing interest in a page on the social networking system, sharing a link with other users of the social networking system, and commenting on posts made by other users of the social networking system.

In one embodiment, an edge may include various features each representing characteristics of interactions between users, interactions between users and object, or interactions between objects. For example, features included in an edge describe rate of interaction between two users, how recently two users have interacted with each other, the rate or amount of information retrieved by one user about an object, or the number and types of comments posted by a user about an object. The features may also represent information describing a particular object or user. For example, a feature may represent the level of interest that a user has in a particular topic, the rate at which the user logs into the online system **140**, or information describing demographic information about a user. Each feature may be associated with a source object or user, a target object or user, and a feature value. A feature may be specified as an expression based on values describing the source object or user, the target object or user, or interactions between the source object or user and target object or user; hence, an edge may be represented as one or more feature expressions.

The edge store **325** also stores information about edges, such as affinity scores for objects, interests, and other users. Affinity scores, or "affinities," may be computed by the online system **140** over time to approximate a user's affinity for an object, interest, and other users in the online system **140** based on the actions performed by the user. A user's affinity may be computed by the online system **140** over time to approximate a user's affinity for an object, interest, and other users in the online system **140** based on the actions performed by the user. Computation of affinity is further described in U.S. patent application Ser. No. 12/978,265, filed on Dec. 23, 2010, U.S. patent application Ser. No. 13/690,254, filed on Nov. 30, 2012, U.S. patent application Ser. No. 13/689,969, filed on Nov. 30, 2012, and U.S. patent application Ser. No. 13/690,088, filed on Nov. 30, 2012, each of which is hereby incorporated by reference in its entirety. Multiple interactions between a user and a specific object may be stored as a single edge in the edge store **325**, in one embodiment. Alternatively, each interaction between a user and a specific object is stored as a separate edge. In some embodiments, connections between users may be stored in the user profile store **305**, or the user profile store **305** may access the edge store **325** to determine connections between users.

As discussed above with reference to FIG. **1**, PII is information that can be used on its own or with other information to identify, contact, or locate a single person, or to identify an individual in context. Thus, PII for a user may exist in different locations on the online system **140**. For example, user profile information in the user profile store **305**, information describing connections between the user and other users in the edge store **325**, etc.

The authorization server **330** enforces one or more privacy settings of the users of the online system **140**. A privacy setting of a user determines how particular information associated with a user can be shared, and may be stored in the user profile of a user in the user profile store **305** or stored in the authorization server **330** and associated with a user profile. In one embodiment, a privacy setting specifies particular information associated with a user and identifies the entity or entities with whom the specified information may be shared. Examples of entities with which information can be shared may include other users, client applications **117**, third-party applications **115**, third-party systems **105** or any entity that can potentially access the information. Examples of information that can be shared by a user include user profile information like profile photo, phone numbers associated with the user, user's connections, actions taken by the user such as adding a connection, changing user profile information and the like.

The privacy setting specification may be provided at different levels of granularity. In one embodiment, a privacy setting may identify specific information to be shared with other users. For example, the privacy setting identifies a work phone number or a specific set of related information, such as personal information including profile photo, home phone number, and status. Alternatively, the privacy setting may apply to all the information associated with the user.

The set of entities that can access particular information may also be specified at various levels of granularity. Various sets of entities with which information can be shared may include, for example, all users connected to the user, a set of users connected to the user, additional users connected to users connected to the user all applications, all third-party applications **115**, specific third-party applications **115**, all third-party systems **105**, specific third-party systems **105**, or all external systems.

The authorization server **330** receives anonymous login requests from third-party applications **115** operating on one or more client devices **110**. For a given client device **110**, the authorization server **330** determines if the user of the client device **110** is currently logged into the online system **140**, and if not, may prompt the user for their login information for the online system **140**. In some embodiments, the prompt may be part of the permissions UI.

The authorization server **330** generates a permissions UI including one or more interface components that obtains and/or confirms the user's permissions information. As discussed above with reference to FIG. **1**, the permissions UI may include, e.g., an interface component requesting the user's login information for the online system **140**; one or more interface components allowing a user to select what, if any, PII may be shared with the third-party system **105**; one or more interface components providing information explaining the selected login method; one or more interface components allowing a user to create and/or select a login persona; or some combination thereof.

In some embodiments, authorization server **330** generates interface components for the permissions UI based in part on, e.g., whether the anonymous login request is the first received from the third-party application **115** for the user, the number of times the user had previously logged into the third-party system **105** using ASSO, whether the user had previously logged into the third-party application **115** using a validated login option, or some combination thereof. For example, a permission UI presented to a user using the ASSO for the first time may include specific interface components that explain the process.

In embodiments where the user had previously logged into the third-party system **105** using ASSO, the authorization server **330** may generate one or more interface components for the permissions UI that prompt the user to confirm and/or update what PII of the user may be shared with the third-party application **115** and/or third-party system **105**. Additionally, if the user had previously logged into the third-party system **105** using a validated login option, the authorization server **330** may generates one or more interface components for the permissions UI that, e.g., notify the user that they have previously logged into the third-party system **105** using a validated login option, notify the user that ASSO is not available for the third-party system **105**, provide a validated login option, or some combination thereof.

In some embodiments, the permissions UI may include an interface component that allows a user to create login personas and/or modify existing login personas. The interface component allows a user to customize what portions of user PII are shared/not shared for each persona.

The authorization server **330** generates a permissions UI based on how the user previously logged into the third-party system **105**. The authorization server determines a number of times the online system **140** has received anonymous login requests associated with the user and the third-party application **115**, whether the user previously logged into the third-party application **115** using the validated login method, what if any PII of the user has previously been shared with the third-party system **105**, or some combination thereof. The authorization server **330** generates a permissions UI based on the above determination. For example, interface components may be different if this is the first time the user has requested the anonymous login option versus a user who has previously logged into the third-party application **115** via the anonymous login option.

The informational interfaces present content to the user relating to the user's selection of the anonymous login option. The authorization server **130** includes different informational interfaces in the permissions UI based on whether the anonymous login request is the first received from the third-party application **115** for the user, whether the user had previously logged into the third-party application **115** using ASSO, and whether the user had previously logged into the third-party application **115** using a validated login option. Examples of informational interfaces are discussed below with reference to FIGS. **5-7**. The authorization server **130** is configured to provide the permissions UI to the client device **110**.

In some embodiments, the authorization server **330** includes an interface component in the permissions UI to obtain from the user some or all of their login information for the online system **140**, thus providing an extra layer of security.

The authorization server **130** receives permissions information from the client device **110**. In some embodiments, the authorization server **130** is configured to update the login database **335** with the received permissions information (e.g., identifies what, if any, PII may be shared with the third-party system **105**).

The login database **335** stores information used by the online system **140** to facilitate ASSO of its users into one or more third-party systems **105**. The login database **335** may store, e.g., permissions information, portions of user PII, access tokens, anonymous identifiers, a number of times the online system **140** has received anonymous login requests associated with the user and the third-party application **115**, information describing previous login methods of the user for a third-party system **105**, information describing PII of the user that has previously been shared with the third-party system **105**, or some combination thereof. In some embodiments, the stored permissions information is mapped to, e.g., a user ID, an access token, an anonymous identifier, or some combination thereof.

The token generator **340** generates access tokens. An access token is an opaque string that is unique and is associated with the user and the third-party application **115** and/or the third-party system **105**. In some embodiments, the access tokens are only valid for a particular amount of time, after which, the access token expires. In some embodiments, the tokens are independent of the client device **110**. Thus, a user may utilize an existing access token on multiple client devices **110** that have the third-party application **115**. The token generator **340** stores generated access tokens in the login database **335**.

In some embodiments, the token generator **340** determines if access tokens have been previously generated for third-party applications **115**. For example, the token generator **340** may determine if an access token is available for a particular user and third-party application **115** and/or third-party system **105** using information in the login database **335**. In embodiments where an access token is available, the token generator **340** may provide it to the requesting client device **110**. Access tokens stored in the login database **335** that have expired are not valid, and thus may not be provided

to the requesting client device **110**. Accordingly, the token generator **340** generates a new access token **340**, updates the login database **335** with the new access token, and provides the new access token to the requesting client device **110**.

The login manager **345** manages requests for anonymous identifiers from third-party applications **115** operating on the client devices **110**. For a given requesting third-party application **115**, the login manager **345** generates an anonymous identifier.

The login manager **345** may generate the anonymous identifier by creating the anonymous identifier using an access token provided by the third-party application **115**. The login manager **345** may create the anonymous identifier by, e.g., a random character generator, a one-way hash of some of the user's PII, a one-way hash of some of the user's PII combined with information identifying the third-party application **115** and/or the third-party system **105**, one-way hash of some or all of the permissions information, some other technique to create a stable identifier, or some combination thereof. Additionally, in some embodiments, the login manager **345** may generate the anonymous identifier by retrieving a previously created anonymous identifier from the login database **335**. The login manager **345** provides the anonymous identifier to the requesting third-party application **115** on the client device **110**. In some embodiments, a previously generated anonymous identifier may be valid for a particular period of time (e.g., the duration of time associated with the access token). In embodiments, where the anonymous identifier retrieved from the login database **335** is not valid, the login manager **345** may, e.g., instruct the authorization server **330** to generate and provide a permissions UI to the client device **110** to re-validate the user's permissions information.

The web server **350** links the online system **140** via the network **220** to the one or more client devices **110**, as well as to the one or more third-party systems **105**. The web server **140** serves web pages, as well as other web-related content, such as JAVA®, FLASH®, XML and so forth. The web server **350** may receive and route messages between the online system **140** and the client device **110**, for example, instant messages, queued messages (e.g., email), text messages, short message service (SMS) messages, or messages sent using any other suitable messaging technique. A user may send a request to the web server **350** to upload information (e.g., images or videos) that are stored in the content store **310**. Additionally, the web server **350** may provide application programming interface (API) functionality to send data directly to native client device operating systems, such as IOS®, ANDROID™, WEBOS® or RIM®.

Method for Anonymous Single Sign-on for a Third-Party System

FIG. **4** is a flowchart illustrating a process for providing anonymous single sign-on functionality to users of the online system **140** for logging into third-party systems **105** according to an embodiment. In one embodiment, the process of FIG. **4** is performed by the online system **140**. However, in other embodiments, other entities may perform some or all of the steps of the process. Likewise, embodiments may include different and/or additional steps, or perform the steps in different orders.

The online system **140** receives an anonymous login request from a third-party application **115** located on a client device **110** associated with a user of the online system **140**. Responsive to receiving the anonymous login request, the online system **140** generates **420** a permissions UI including one or more interface components. The interface components of the permissions UI are based in part on, e.g., whether the user is logged into the online system **140**; whether the user previously logged into the third-party application **115** and, if so, whether the user logged in using an anonymous login option or a validated login option; what if any of the user's PII the user has previously elected to share with the third-party application **115** and/or third-party system **105**, or some combination thereof. Additionally, in some embodiments, the permissions UI may include one or more interface components enabling a user to create and/or select a login persona.

In some embodiments, if the user is logged into the online system **140** when the anonymous login request is received, the permissions UI may include only a single interface component from which the user can complete anonymous login. This is discussed in detail below with regard to FIG. **6**.

In some embodiments, the interface components may include several different login methods, for example, one interface component may allow a user to login fully anonymously, a second interface component may allow a user to log into the third-party system **105** while only sharing a particular portion of their PII with the third-party system **105**, and third interface component may allow a user to log into the third-party system **105**—but choose exactly what portions of their PII (if any) they are willing to share with the third-party system **105**. Some examples of permissions UIs and interface components are discussed below with reference to FIGS. **5-8**.

The online system **140** provides **430** the generated permissions UI to the client device **110**. The client device **110** presents the permissions UI to the user via, e.g., a client application **117**.

The online system **140** receives **440** permissions information from the permissions UI. The permissions information controls what, if any, PII the user has elected to allow the online system **140** to share with the third-party application **115** and/or the third-party system **105**. For example, the permissions information may indicate that a user will only share their gender. In some cases, the permissions information may indicate that the user does not want any PII shared with the third-party application **115** and/or the third-party system **105**.

Responsive to receiving the permissions information, the online system **140** generates **450** an access token. The generated access token is used by the third-party application **115** to request an anonymous identifier. The online system **140** may store the generated access token in database (e.g., login database **335**). Additionally, in some embodiments, the generated access token may be valid only for a particular duration of time (e.g., 2 hours). The online system **140** provides **460** the access token to the third-party application **115**.

The online system **140** receives **470** a request from the third-party application **115** for an anonymous identifier, the request including the access token. Responsive to receiving the request, the online system **140** generates **480** the anonymous identifier. For example, the online system **140** may retrieve a pre-existing anonymous identifier from a database using the received access token. Alternatively, the online system **140** may create the anonymous identifier. For example, the online system **140** may create the anonymous identifier by, e.g., taking a one way hash of some of the user's PII. The online system **140** provides **490** the anonymous identifier to the requesting third-party application **115**.

In alternate embodiments, responsive to receiving permissions information from the client device **440**, the online

system **140** generates the anonymous identifier, and then provides the anonymous identifier to the client.

FIG. **5** illustrates a series of interfaces **500** displayed to a user of the client device **100** to provide fully anonymous login according to an embodiment. The interfaces **500** include interfaces **505**, **510**, **515**, **520**, and **525**. The interface **505** is an interface presented by the client device **100** if the user attempts to log into an application titled "THP" via the client device **100**. The third-party application **115** presents, via the client device **100**, the interface **505** prompting the user to select a login method. The interface **505** displays two login method options, specifically, "Log in via Online System" **530** (which is a validated login option) and "Log in Anonymously" **535** which is (which is an anonymous login option). If the user selects Log in via Online system **530**, the user is logged in via the online system **140** and some of the user's PII may be shared with the third-party application **115** and/or an associated third-party system **105**. In contrast, if the user selects Log in Anonymously **535** the user is electing to log into the third-party system **105** without sharing any PII with the third-party application **115** and/or an associated third-party system **105**.

In response to the user selecting **537** the Log in Anonymously **535** login method option, the third-party application **115** generates an anonymous login request and sends it to the online system **140**. The client device **110** receives a permissions UI from the online system **140**. The permissions UI comprises interfaces **510**, **515**, and **520** (also may be referred to as interface components). Interfaces **510**, **515**, and **520** are informational interfaces that describe what it means to be logged in anonymously to the third-party system **105**. For example, interface **510** introduces anonymous login as a way to try out new apps. In this embodiment, interface **515** explains that, in general, being logged in anonymously means no PII of the user is shared with the third-party applications and third-party applications will not be able to post any information to the online system **140**. Interface **520** notes that the third-party application **115** may still solicit information from you and provides a "Log In" option **540** for user selection to complete the anonymous login of the user into the third-party system **105**. The user may move from interface **510** to **515** by swiping horizontally from right to left on displayed interface, similarly, the user may move from interface **515** to **520** in a similar manner. Likewise a user may move from interface **520** to **515** and from interface **515** to **510** by swiping horizontally from left to right on the displayed interface. A user may exit the anonymous login process by selecting a "Cancel" button **545**, selection of some button on the client device **100** that causes the user to exit the process, receipt of some other command from the user causing the user to exit the anonymous login process, etc. After the user has scrolled through the interfaces **510** and **515**, the user completes the anonymous login process by selecting **550** the Log In button **540**, causing the permissions UI to send permissions information to the online system **140**.

As described above with respect to FIGS. **1** and **3**, the online system **140** generates an access token, provides the access token to the third-party application **115** which the third-party application **115** uses to request an anonymous identifier for the user. The online system **140** generates the anonymous identifier and provides it to the third-party application **115**. The third-party application **115** logs the user into the third-party system **105** as an anonymous user, and the third-party application **115** presents interface **525** to the user via the client device **100**.

FIG. **6** illustrates another series of interfaces **600** displayed to a user of the client device **100** to provide fully anonymous login according to an embodiment. The interfaces **600** include interfaces **605**, **610**, **615**, and **620**. The interface **605** is substantially similar to the interface **505** described above with regard to FIG. **5**.

In response to the user selecting **537** the Log in Anonymously **535** login method option, the THP generates an anonymous login request and sends it to the online system **140**, and a client device **110** receives a permissions UI from the online system **140**. In this example, the permissions UI is presented by a client application **117** operating on the client device **110**, and the permissions UI comprises interfaces **610** and **615**.

In this embodiment, the permissions UI comprises fewer interfaces than, for example, the permissions UI described above with respect to FIG. **5**. The interfaces **610** and **620** of FIG. **6** may be useful for cases where the user has previously logged into a third-party application **115** as an anonymous user and would be familiar with the effects of being logged into a third-party system **105** as an anonymous user. Additionally, in alternate embodiments, if a user is already logged into the online system **140**, the permissions UI may only include interface **610**. Thus, the three interfaces (**510**, **515**, and **520**) in FIG. **5** are replaced with two interfaces (**610** and **615**) or possibly even one interface **610**. In this embodiment, interface **610** provides general description of what it means to log in anonymously and prompts the user to continue with anonymous login via selection of a "Log In" button **625** or cancelling the process via a "Cancel" button **630**.

In this embodiment, responsive to a selection **635** of the Log In button **625** the client device **110** presents interface **615** prompting the user for their login information for the online system **140**. This is a useful security measure as it helps ensure the user is the individual anonymously logging into the third-party system **105**. After the user enters their login information for the online system **140** and selects **640** the "Log In" button **645**, the permissions UI provides permissions information to the online system **140**. In alternate embodiments, the interface **615** may be included only if the user is not currently logged into the online system **140**.

As described above with respect to FIGS. **1**, **3**, and **5**, logs the user into the third-party system **1-5** as an anonymous user, and the third-party application **115** presents interface **620** to the user via the client device **100**.

FIG. **7** illustrates a permissions UI **700** that provide graduated control of what PII is provided to the third-party application **115**, according to an embodiment. The permissions UI **700** includes interfaces **705**, **710**, and **715** that are presented by the client application **117** and allow a user to select what, if any, PII of the user be shared with the third-party system **105** and/or the third-party application **115**.

Interface **705** presents an option for the user to log into the third-party system **105** via a validated login by selecting the "OK" button **720**. As discussed above, a user selecting this option allows the online system **140** to share PII with the third-party system **105** and/or the third-party application **115**.

Interface **710** presents an anonymous login option to the user that is pre-configured to allow the online system **140** share only specific PII relating to the public profile of the user with the third-party system **105** and/or the third-party application **115**. Thus, a user may log into the third-party system **105** in a partially anonymous manner where some, but not all (i.e., their public profile), of their PII is shared with the third-party system **105** and/or the third-party application **115** via selection of the "OK" button **725**.

Interface **715** presents an anonymous login option to the user that allows the user to select which items of their PII may be shared with the third-party system **105** and/or the third-party application **115**. In this example, the interface **715** allows the user to elect to share or not share their email address information **730**, their public profile information **735**, and their likes **740**. In alternate embodiments, the interface **715** may include additional and/or different PII which the user may elect to share and/or not share with the third-party system **105** and/or the third-party application **115**. In this example, the user has elected to only share their email address information **730** via toggling the switch **745** to the ON position, while keeping the switches **750** and **755** in the OFF position. Accordingly, the interface **715** provides the user with graduated control over what PII may be shared with the third-party system **105** and/or the third-party application **115**. In embodiments, where some, but not all, of the information is shared, the online system **140** logs the user into the third-party system **105** in a partially anonymous manner. Additionally, in embodiments, where the user chooses to not share any PII, the online system **140** logs the user into the third-party system **105** in a fully anonymous manner.

A user is able to navigate from interface **705** to **710** by swiping horizontally from right to left on displayed interface, similarly, the user may move from interface **710** to **715** in a similar manner. Likewise a user may move from interface **715** to **710** and from interface **710** to **705** by swiping horizontally from left to right on the displayed interface. A user is able to select a login option associated with the interface **705**, **710**, or **715**, by selecting the OK button on that interface, specifically, the OK button **720**, the OK button **725**, or the OK button **760**, respectively. Additionally, the user is able to exit the permission UI **700** by selecting any of the Cancel buttons **765**.

Turning now to a discussion of embodiments where the online system **140** prevents a user from continuing with ASSO, FIGS. **8**A and **8**B show two specific cases. Such cases may be implemented to provide incentive to users to share some PII with third-party applications **115** which they are using regularly. Or, for example, such cases may inform the user that ASSO holds no benefit for the user for a particular third-party application **115**, as the user may have previously logged into the third-party system **105** using a method that already shared the user's PII with the third-party application **115** and/or the third-party system **105**. Additionally, such cases provide incentive for other third-party systems **105** to allow ASSO on their third-party applications **115**.

In some embodiments, a user may select an anonymous login option, however, the permissions UI may not allow them to login anonymously. As noted above, the online system **140** generates the permissions UI based in part on how the user previously logged into the third-party system **105**. In some embodiments, the user may have previously logged into the third-party system **105** via the validated login option, accordingly, the permissions UI may include an interface component notifying the user that they previously logged into the third-party system **105** and allow them to continue to log into the third-party system **105** in this manner and not via anonymous login. For example, FIG. **8**A illustrates a permissions UI **800** prompting a user to log into a third-party application **115** using the online system **140**, according to an embodiment. The permissions UI **800** allows the user to continue to login using the online system **140**, but does not allow the user to anonymously log into the third-party application **115**.

Additionally, in some embodiments, the online system **140** may allow the user to log into the third-party application **115** anonymously a specific number of times (e.g., one or more times). Once a particular threshold value is passed, the online system **140** may prohibit the user from anonymously logging into the third-party system **105**, and prompt the user to log into the third-party system **105** using a validated login method. For example, FIG. **8**B illustrates another permissions UI **810** redirecting a user to log into a third-party application **115** using the online system **140**, according to an embodiment. In this example, the permissions UI **810** includes an interface component **820** that notifies the user that they have previously logged into the third-party system **105** anonymously, and indicates that they may log into the third-party system **105** via a validated login method. Responsive to a selection of the "Next" button **840**, the permission UI **810** presents an interface component **830** to the user. In this example, the interface component **830** explains to the user that if they elect to continue, some of their user PII may be shared with the third-party application **115** and/or the third-party system **105**. A user may continue the login by selecting the "Log In" button **850** or cancel the log in by selecting the "Cancel" button **860**. Thus, the online system **140** is able to effectively limit the number of times a user is allowed to anonymously log in into a third-party system **115**.

The online system **140** may infer that a user likes a particular third-party system **105** and/or third-party application **115** if the user continually requests anonymous login for the particular third-party system **105** and/or third-party application **115**. In some embodiments, if a user has requested to log into the third-party system **105** anonymously, and has previously logged into the third-party system **105** anonymously one or more times, the online system **140** prompts the user to upgrade their login method. For example, the online system **140** may still allow the user to continue with anonymous login in the permissions UI, but also includes one or more options in the permissions UI that allow the user to alternatively log in as partially anonymous and/or via the validated login method. Thus, the online system **140** may attempt to upgrade the user into a login method where PII may be shared for third-party systems and/or third-party applications that the user appears to like.

In some embodiments, the online system **140** may monitor which third-party systems **105** and/or third-party applications **115** the user is currently anonymously logged into (fully and/or partially) or via the validated login method. The online system **140** identifies which third-party systems **105** and/or third-party applications **115** the user is logged into, and generates a dashboard graphical user interface that lists the identified third-party systems **105** and/or third-party applications **115**. The online system **140** provides the dashboard to the client application **117** for presentation to the user. This allows the user to easily determine, e.g., what third-party systems **105** and/or third-party applications **115** they are logged into anonymously and what third-party systems **105** and/or third-party applications **115** they are logged into with the validated login method. In some embodiments, the listed third-party applications **115** are selectable, such that a user may select a listed third-party application **115** to bring the application to the foreground.

Summary

The foregoing description of the embodiments of the disclosure has been presented for the purpose of illustration; it is not intended to be exhaustive or to limit the disclosure to the precise forms disclosed. Persons skilled in the relevant

art can appreciate that many modifications and variations are possible in light of the above disclosure.

Some portions of this description describe the embodiments of the disclosure in terms of algorithms and symbolic representations of operations on information. These algorithmic descriptions and representations are commonly used by those skilled in the data processing arts to convey the substance of their work effectively to others skilled in the art. These operations, while described functionally, computationally, or logically, are understood to be implemented by computer programs or equivalent electrical circuits, microcode, or the like. Furthermore, it has also proven convenient at times, to refer to these arrangements of operations as modules, without loss of generality. The described operations and their associated modules may be embodied in software, firmware, hardware, or any combinations thereof.

Any of the steps, operations, or processes described herein may be performed or implemented with one or more hardware or software modules, alone or in combination with other devices. In one embodiment, a software module is implemented with a computer program product comprising a computer-readable medium containing computer program code, which can be executed by a computer processor for performing any or all of the steps, operations, or processes described.

Embodiments of the disclosure may also relate to an apparatus for performing the operations herein. This apparatus may be specially constructed for the required purposes, and/or it may comprise a general-purpose computing device selectively activated or reconfigured by a computer program stored in the computer. Such a computer program may be stored in a non-transitory, tangible computer readable storage medium, or any type of media suitable for storing electronic instructions, which may be coupled to a computer system bus. Furthermore, any computing systems referred to in the specification may include a single processor or may be architectures employing multiple processor designs for increased computing capability.

Embodiments of the disclosure may also relate to a product that is produced by a computing process described herein. Such a product may comprise information resulting from a computing process, where the information is stored on a non-transitory, tangible computer readable storage medium and may include any embodiment of a computer program product or other data combination described herein.

Finally, the language used in the specification has been principally selected for readability and instructional purposes, and it may not have been selected to delineate or circumscribe the inventive subject matter. It is therefore intended that the scope of the disclosure be limited not by this detailed description, but rather by any claims that issue on an application based hereon. Accordingly, the disclosure of the embodiments is intended to be illustrative, but not limiting, of the scope of the disclosure, which is set forth in the following claims.

What is claimed is:

**1**. A non-transitory computer-readable storage medium storing executable computer program instructions, the computer program instructions comprising instructions that when executed cause a computer processor to perform steps comprising:

receiving, by an online system from a third-party application on a client device of a user, an indication that a user who is logging into the third party system associated with the third party application:

(1) has selected an anonymous login option at a login page of the third party application that has a validated login option and the anonymous login option, and

(2) has been redirected to the online system to implement the user's anonymous login request to anonymously log the user into the third party system, the third party system being external to and separate from the online system;

responsive to receiving the anonymous login request, generating by the online system a permissions user interface ("UI") that provides an interface component including an option for the user to anonymously log into the third party system using the user's login information for the online system;

providing the permissions UI to the client device, wherein responsive to input from the user, the permissions UI generates permissions information confirming that the user has requested to anonymously log into the third party system without the online system sharing any personally identifiable information ("PII") of the user with the third-party application and the third party system;

responsive to receiving the permission information, generating an access token for the user to anonymously log into the third party system;

providing the access token to the third-party application;

receiving a request for an anonymous identifier from the third-party application, the request including the access token;

generating, by the online system, an anonymous identifier that allows the user to login to the third party system, wherein the anonymous identifier is unique to the client device and to the third party system associated with the third party application such that the anonymous identifier can be re-used by the user to anonymously login to the third party application in the future; and

providing the anonymous identifier to the third-party application to allow anonymous single sign-on of the user into the third party system in accordance with the permissions information.

**2**. The non-transitory computer-readable storage medium of claim **1**, wherein generating the permissions UI further comprises:

generating a second interface component that provides the user with an option to log into the third party system via a validated login option that shares the user's PII with the third-party application; and

generating a third interface component that provides the user with an option to log into the third party system via an anonymous login option that shares some, but not all, of user's PII, with the third-party application.

**3**. The non-transitory computer-readable storage medium of claim **1**, wherein the instructions, when executed, further cause a computer processor to perform steps comprising:

identifying a plurality of third-party systems the user is logged into, the plurality of third-party systems including the third party system;

generating a graphical user interface that lists the identified third-party systems; and

providing the graphical user interface to the client device.

**4**. The non-transitory computer-readable storage medium of claim **3**, wherein the identified plurality of third-party systems the user is logged into includes at least one third-party system that the user is logged into via a validated login option that shares the user's PII with the third-party application.

5. The non-transitory computer-readable storage medium of claim 1, wherein the instructions, when executed, further cause a computer processor to perform steps comprising:

receiving another anonymous login request from the third-party application on the client device;

determining that a number of times the online system has received anonymous login requests associated with the user and the third-party application is greater than a threshold value;

generating a second permissions UI that provides the user with an option to log into the third party system using the user's login information for the online system in a manner that shares some of the user's PII with the third-party application; and

providing the second permissions UI to the client device.

6. The non-transitory computer-readable storage medium of claim 1, wherein the instructions, when executed, further cause a computer processor to perform steps comprising:

receiving another anonymous login request from the third-party application on the client device;

determining that a number of times the online system has received anonymous login requests associated with the user and the third-party application is greater than a threshold value;

generating a second permissions UI that provides the user with an option to log into the third party system using the user's login information for the online system in a manner that shares some, but not all, of the user's PII with the third-party application; and

providing the second permissions UI to the client device.

7. A method comprising:

receiving, by an online system from a third-party application on a client device of a user, an indication that a user who is logging into the third party system associated with the third party application:

(1) has selected an anonymous login option at a login page of the third party application that has a validated login option and the anonymous login option, and

(2) has been redirected to the online system to implement the user's anonymous login request to anonymously log the user into the third party system, the third party system being external to and separate from the online system;

responsive to receiving the anonymous login request, generating by the online system a permissions user interface ("UI") that provides an interface component including an option for the user to anonymously log into the third party system using the user's login information for the online system;

providing the permissions UI to the client device, wherein responsive to input from the user, the permissions UI generates permissions information confirming that the user has requested to anonymously log into the third party system without the online system sharing any personally identifiable information ("PII") of the user with the third-party application and the third party system;

responsive to receiving the permission information, generating an access token for the user to anonymously log into the third party system;

providing the access token to the third-party application;

receiving a request for an anonymous identifier from the third-party application, the request including the access token;

generating, by the online system, an anonymous identifier that allows the user to login to the third party system, wherein the anonymous identifier is unique to the client device and to the third party system associated with the third party application such that the anonymous identifier can be re-used by the user to anonymously login to the third party application in the future; and

providing the anonymous identifier to the third-party application to allow anonymous single sign-on of the user into the third party system in accordance with the permissions information.

8. The method of claim 7, wherein generating the permissions UI further comprises:

generating a second interface component that provides the user with an option to log into the third party system via a validated login option that shares the user's PII with the third-party application; and

generating a third interface component that provides the user with an option to log into the third party system via an anonymous login option that shares some, but not all, of user's PII, with the third-party application.

9. The method of claim 7, further comprising:

identifying a plurality of third-party systems the user is logged into, the plurality of third-party systems including the third party system;

generating a graphical user interface that lists the identified third-party systems; and

providing the graphical user interface to the client device.

10. The method of claim 9, wherein the identified plurality of third-party systems the user is logged into includes at least one third-party system that the user is logged into via a validated login option that shares the user's PII with the third-party application.

11. The method of claim 7, further comprising:

receiving another anonymous login request from the third-party application on the client device;

determining that a number of times the online system has received anonymous login requests associated with the user and the third-party application is greater than a threshold value;

generating a second permissions UI that provides the user with an option to log into the third party system using the user's login information for the online system in a manner that shares some of the user's PII with the third-party application; and

providing the second permissions UI to the client device.

12. The method of claim 7, further comprising:

receiving another anonymous login request from the third-party application on the client device;

determining that a number of times the online system has received anonymous login requests associated with the user and the third-party application is greater than a threshold value;

generating a second permissions UI that provides the user with an option to log into the third party system using the user's login information for the online system in a manner that shares some, but not all, of the user's PII with the third-party application; and

providing the second permissions UI to the client device.

13. A system comprising:

a processor; and

a non-transitory computer-readable storage medium storing executable modules that when executed cause the processor to perform steps comprising:

receiving, by an online system from a third-party application on a client device of a user, an indication that a user who is logging into the third party system associated with the third party application:

(1) has selected an anonymous login option at a login page of the third party application that has a validated login option and the anonymous login option, and

(2) has been redirected to the online system to implement the user's anonymous login request to anonymously log the user into the third party system, the third party system being external to and separate from the online system;

responsive to receiving the anonymous login request, generating by the online system a permissions user interface ("UI") that provides an interface component including an option for the user to anonymously log into the third party system using the user's login information for the online system;

providing the permissions UI to the client device, wherein responsive to input from the user, the permissions UI generates permissions information confirming that the user has requested to anonymously log into the third party system without the online system sharing any personally identifiable information ("PII") of the user with the third-party application and the third party system;

responsive to receiving the permission information, generating an access token for the user to anonymously log into the third party system;

providing the access token to the third-party application;

receiving a request for an anonymous identifier from the third-party application, the request including the access token;

generating, by the online system, an anonymous identifier that allows the user to login to the third party system, wherein the anonymous identifier is unique to the client device and to the third party system associated with the third party application such that the anonymous identifier can be re-used by the user to anonymously login to the third party application in the future; and

providing the anonymous identifier to the third-party application to allow anonymous single sign-on of the user into the third party system in accordance with the permissions information.

**14**. The system of claim **13**, wherein

generating the permissions UI further comprises generating a second interface component that provides the user with an option of selecting a login persona, of a plurality of login personas, wherein each persona identifies different types of the user's PII that are not shared with the third party system if the user elects to log into the third party system using that persona; and

the received permissions information identifies a login persona selected by the user, configured to share at least one type of PII with the third party system.

**15**. The system of claim **13**, wherein generating the permissions UI further comprises:

generating a second interface component that provides the user with an option to log into the third party system via a validated login option that shares all types of the user's PII with the third-party application; and

generating a third interface component that provides the user with an option to log into the third party system via an anonymous login option that shares some, but not all, of user's PII, with the third-party application.

**16**. The system of claim **13**, wherein the received permissions information indicates that no PII is to be shared with the third-party application.

**17**. The system of claim **13**, wherein the received permissions information identifies at least one portion of the user's PII is to be shared with the third-party application, and wherein the executable modules when executed cause the processor to perform steps further comprising:

sharing the identified portion of the user's PII with the third-party application.

**18**. The system of claim **13**, wherein the executable modules when executed cause the processor to perform steps further comprising:

receiving another anonymous login request from the third-party application on the client device;

determining that a number of times the online system has received anonymous login requests associated with the user and the third-party application is greater than a threshold value;

generating a second permissions UI that provides the user with an option to log into the third party system using the user's login information for the online system in a manner that shares some of the user's PII with the third-party application; and

providing the second permissions UI to the client device.

**19**. The system of claim **13**, wherein the executable modules when executed cause the processor to perform steps further comprising:

identifying a plurality of third-party systems the user is logged into, the plurality of third-party systems including the third party system;

generating a graphical user interface that lists the identified third-party systems; and

providing the graphical user interface to the client device.

**20**. The system of claim **19**, wherein the identified plurality of third-party systems the user is logged into includes at least one third-party system that the user is logged into via a validated login option that shares the user's PII with the third-party application.

**21**. The method of claim **7**, wherein providing the anonymous identifier to the third-party application allows graduated single sign-on of the user into the third party system in accordance with the permissions information.

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